

Utilization of ICT Tools for Fishing by the Fishermen in Coastal Districts of Tamil Nadu State, India

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ABSTRACT

The invasion of information and communication technology tools made the fisheries sector a greater extent of the economically viable behaviour towards fishing. The progression over the accession of information and communication technology (ICT) tools made fishing easier and more efficient. This present investigation proclaims the level and pattern of utilization of ICT for fishing. A total of 200 fishermen were selected from the significant four coastal districts of Tamil Nadu viz., Ramanathapuram, Thoothukudi, Tirunelveli and Kanyakumari. A total of eight fishing villages in each district were selected for the study. The respondents were selected through proportionate sampling in the study area and the data were collected through personal interviews. The most commonly used ICT tools and its utilization level by the fishermen enlisted for the study were GPS (90%), potential fishing zone-remote sensing resonance (80%), SONAR/Echo Sounder (45%), android mobile applications (90%), television and radio (49%), ICT displays (45%), on-board data integrators (53%), other electronic gadgets (32%), E-fishing (3%) and internet linkages (2%). More than half of the respondents (62%) had a medium level of utilization of ICT tools for fishing, followed by a high level (23%) and a low level (15%). Among 21 independent variables selected for the study, 14 independent variables were showing 99% significance. Besides, 9 and 5 independent variables were shown positive association and negative association with the dependent variables, respectively. In this study, R² implied that the independent variables can predict with an accuracy value of 60.30% to the extent of utilization of ICT tools for fishing. The composite reliability values obtained from the SEM analysis for this study has critically inferred that the value of 0.85 shows that the model summary is fit for analysis. The findings encourage the development of ICT infrastructure and support systems through governmental interventions in order to optimize technology advancements for the fishing industry.

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PNA: Collection of primary and secondary data, data analysis and preparation of primary version of manuscript. GA: A skeptical viewer of the research work, data analysis and technical assistance. NVS: Validated the results and proof reading of manuscript. TR: Reviewed the manuscript before final submission. CLC: Provided suggestion for the manuscript and reviewed the paper.

Key words

Utilization of ICT Tools for Fishing in Coastal Districts of Tamil Nadu, Information and communication technology, ICT tools, Echo sounder, Android mobile application, Fishing in Tamil Nadu waters

INTRODUCTION

India is a peninsular country that is rapidly developing land has a promising future beside the seas and oceans. The nation has made efforts on the information and communication technology site to accomplish its

intentional visionary goals and they are making amazing efforts, particularly in the fishing industry, to make fishermen extremely proficient. Digitalization in fisheries focuses on the potential for enhancement of the productivity and profitability of the fisheries sector while also benefiting fishermen from the ability to make informed decisions about climate, fish and sustainable practices (Chandrasekhar, 2021). The central sector plan in line with the Blue Revolution 2016 recommended the safety of fishermen at sea would ensure by providing safety kits consisting of Global Positioning Systems (GPS), echo sounders, life-saving equipment, distress signal transmitters (DATs), VHF radios, sounders, battery backup, search and rescue beacons, etc. at a cost of Rs 2 lakh per kit and to train the fishermen on effective utilization of information and communication technology (ICT) for easier and more

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efficient fishing. GPS and Geospatial Information Systems (GIS) are critical tools for fisheries management, research and planning which include mapping of fishing areas, following fish migration, watching fishing operations, conserving and maintaining fish populations. GIS provides various advantages over traditional approaches, including the capacity to handle enormous geographical datasets fast and correctly (Verma *et al.*, 2023). Among these initiatives in the fisheries sector, the mobile phone and their software applications rank first in disseminating delicate information and critical knowledge to the sea-going fisherfolk. Mobile phones are used to coordinate the fishing efforts (Adogla, 2009), marketing, safety (Anon, 2008) and also linking the fishermen with the wholesalers for business activities (Scheen, 2008). The current study examined the relationship between fishermen's socio-economic characteristics and the utilization level of key ICT tools for fishing such as GPS, PFZ, android mobile apps, television, radio, SONAR, echo sounders, on-board data integrators, internet linkages, e-fishing, and more. These ICT initiatives uphold the decision support systems over the fishermen, causing productive fishing activities. However, the results revealed significant differences in the level of utilization of ICT tools for fishing over the coastal districts of Tamil Nadu state, India. The findings of this study have the potential to guide the creation of focused interventions aimed at augmenting the utilization of ICT tools and strengthening the information management competencies of fishermen. This, in turn, might foster the sustainability and durability of the fisheries industry in Tamil Nadu state. The main objective of the study is to find the extent of utilization of information and communication technology tools for fishing by the fishermen.

MATERIALS AND METHODS

The present research was performed by employing the ex-post facto design and conducted in the selected significant coastal districts Tamil Nadu State *viz*, Ramanathapuram, Thoothukudi, Tirunelveli and Kanyakumari. These coastal districts were selected since the larger fishermen population facilitate respondents for the study. The two most populous villages in each of the selected districts of TN were chosen with a total of eight fishing villages. The sampling sites had been intentionally selected for the study based on the existence of government and non-governmental agencies as well as its exposure to fishermen, with a particular emphasis on the dissemination of ICTs for fishing.

A total of 200 respondents were selected for the study through proportionate sampling from each sampling area. Fishermen as respondents were selected from each

district proportionately based on the total active fisherfolk population of the district. The data were collected through personal interviews with a structured survey schedule. A total of 21 characteristics of respondents which include socio-personal, socio-economic, socio-communication and socio-psychological were selected as independent variables for the study. The dependent variable for the study was the utilization level of information and communication tools for fishing by the fishermen.

Tools for analysis

The data were analyzed with the help of Microsoft-Excel, IBM SPSS Version 26, and AMOS software. The charts were facilitated by ChartExpo and OriginPro software.

RESULTS AND DISCUSSION

Socio depictional characters of the respondents

Table I shows the socio depictional characteristics of the respondents.

Table II shows the Spearman correlation, worked out to find the relationship between the social depictional characteristics of fishermen and level of utilization of ICT tools for fishing by the fishermen.

The structural equation modelling analysis

In the SEM analysis, the independent variables were categorized under 4 branches such as socio-personal (age, education, experience, active fishermen and social participation status), socio-economic (fishing distance, fishing depth, duration of fishing, average fish catch, fishing craft and fishing gear), socio-communication characters (Extension agency contact, information source, mass media exposure and information needs) and socio-psychological (decision making behaviour, innovativeness, scientific orientation, perception of ICT tools for fishing, attitude of ICT for tools for fishing and knowledge of ICT tools for fishing) characteristics that are associated with key dependent variables that have been controlled in the final model. The final model with standardized path coefficients have been illustrated in Figure 1. This model included paths between the key study variables and fitted the data adequately ($\chi^2 [21] = 21.98$, $p = 0.168$; RMSEA = 0.042, 95% CI [0.001, 0.085]; CFI = 0.915).

Figure 1 shows that the unstandardized regression weights show the direct effect of one variable on another in the original units of measurement; therefore, a one-unit increase in socio-personal variables is associated with a 0.349 unit increase in socio-communication variables, holding other variables constant. The standardized regression weights show the direct effect of one variable

Table I. Socio-depictional characteristics of the respondents (N=200).

Variables	Results and discussion
Age Middle (36 to 45)	More than half of the respondents (64.50%) were middle-aged group (Joshua NE, 2009)
Education Middle school	Nearly 26.50% of the fishermen were educated with middle school level (Levi <i>et al</i> , 2015)
Experience Above 15 years	Almost 85% of the respondents were having experience over 15 years (Guguloth, 2013)
Active Fishermen Full time	Almost 84% of the respondents were the full-time fishermen (Aruloli, 2018)
Fishing distance 60-80 Km	Almost 48% of the respondents had fishing over the distance of 60-80 kms (Nithya, 2015)
Fishing depth Above 120 m	Half of the respondents (50.5%) were having fishing with the depth of more of 120 kms (Subramanian <i>et al</i> , 2014)
Duration of fishing 10-15 Hours	More than half of the respondents (66.5%) were having fishing duration from 11-12 hours (Nithya, 2015)
Daily average fish catch More than 400 Kg / Trip	More than half of the respondents (69%) had daily average fish catch of more than 400kgs per fishing trip (Subramanian <i>et al</i> , 2014)
Fishing craft Trawler	Almost 80% of the respondents were using Trawlers for fishing (Velvizhi, 2015)
Fishing gear Trawl net	Almost 70% of the respondents were using Trawl nets for fishing (Shirlashetti, 2015)
Social participation status Medium value (9.81-10.4)	Almost 80% of the respondents had medium level of social participation over their community (Veeraputhiran, 2000)
Extension agency contact Medium value (1.02-1.36)	More than half of the respondents (64%) had medium level of extension agency contact to facilitate effective utilization of ICT tools (Shankar, 2010)
Information source Medium value (3.14-3.46)	Almost 74% of the respondents facilitate medium level of information source exposure (Nithya, 2015)
Mass media exposure Medium value (3.13-3.57)	More than half of the respondents (61%) facilitate medium level for mass media exposure (Ande, 2011)
Information needs Medium value (3.83-5.15)	Almost 85% of the respondents explore medium level of information need over ICT tools (Guguloth, 2013 and Velvizhi, 2015)
Decision making behaviour Medium value (2.48-2.87)	Almost 81.5% of the respondents had moderate decision-making behaviour for the selection of utilization of ICT tools (Pandey and De, 2015)
Innovativeness Medium value (4.09-4.63)	Almost 76% of the respondents possessed moderately substantial level of innovativeness (Nithya, 2015)
Scientific orientation Medium value (3.60-3.87)	Almost 46.5% of the respondents enables medium level of scientific orientation (Guguloth, 2013)
Perception on ICT for fishing Medium value (3.90-4.10)	Half of the respondents (51%) had medium level of perception on utilization of ICT tools (Susilowati and Suciati, 2022)
Attitude on ICT for fishing Medium value (2.96-3.30)	Nearly 76% of the respondents had medium level of attitude on utilization of ICT tools (Sim, 2023)
Knowledge on ICT for fishing Medium value (1.59-1.76)	Nearly 84% of the respondents had medium level of knowledge on utilization of ICT tools (Guguloth, 2013)

on another in standardized units (z-scores); therefore, socio-personal variables have a stronger direct effect on socio-communication (0.663) compared to socio-psychological variables effect on socio-economic

variables (0.709). The socio-personal and socio-variables have a positive covariance of 11.508, suggesting they are positively related. The correlation between socio-personal and socio-economic variables is 0.549,

Table II. The results of Spearman correlation (number of independent variables = 21).

Independent variables	Total number of independent variables	Level of significance
Fishing distance (+), Fishing depth (+), Duration of fishing (+), Daily average fish catch (+), Fishing craft (-), Fishing gear (-), Extension agency contact (-), Information source (+), Mass media exposure (+), Information needs (+), Innovativeness (+), Perception of ICT tools for fishing (-), Attitude of ICT tools for fishing (-) and Knowledge of ICT tools for fishing (+)	14 (Positive correlation = 9) (Negative correlation = 5)	** Correlation is significant at the 0.01 level (2-tailed)
Age, Education, Experience in fishing, Active fishermen, Socio participation status, Decision making behaviour, Scientific orientation	07	Non-significant
(+) - indicates positive association and (-) - indicates negative association		

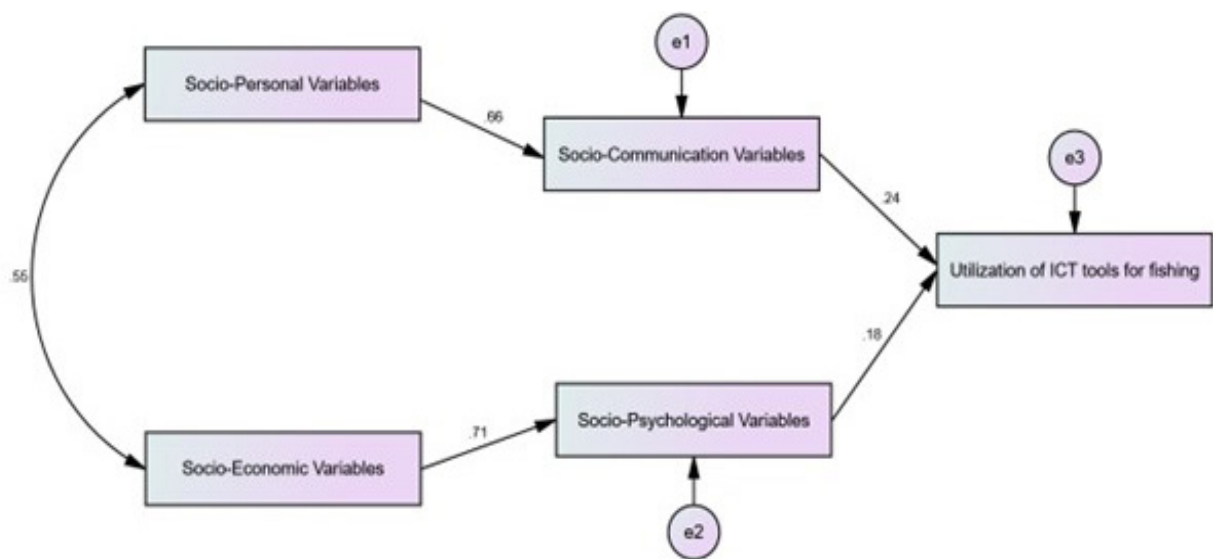


Fig. 1. The final structural equation model.

indicating a moderately positive relationship. The variance of socio-personal variables is 25.429, which means there is a considerable amount of variability in the socio-personal variables. The variables e1, e2, and e3 likely represent error terms in the model. Socio-communication variables are influenced primarily by socio-personal variables (beta= 0.663), with a smaller impact from ICT (0.242). Socio-psychological is strongly influenced by socio-economic variables (beta= 0.709). ICT tools utilization level is influenced to some extent by both socio-economic and socio-psychological variables. Socio-personal and socioeconomic variables are positively correlated and have substantial variances. The significance levels (p-values) for the regression weights, covariances, and variances suggest that these relationships are statistically significant. The CR (critical ratio) is a z-score and values greater than 1.96 or -1.96 typically indicated significance at the 0.05 level. Finally, the composite reliability (CR) value was

calculated as 0.85, showing that the model is fit for analysis.

Level of utilization of ICT tools by the fishermen

Table III shows the level of utilization of information and communication technology tools for fishing. Majority of the respondents were in medium level (62%) of utilization of information and communication technological tools for fishing followed by high (23%) and low (15%).

Table III. Distribution of the respondents according to their degree of utilization of ICT tools for fishing.

Degree of ICT utilization	No	%
Low	30	15
Medium	124	62
High	46	23

From Figure 2, GPS and android mobiles (software applications) hold the highest level of utilization (90%) by the fishermen and the next highest level of utilization is held by the remote sensing satellite system PFZ (80%). The following gadgets such as on-board data integrators

(53%), ICT displays (48%), television and radio (49%), SONAR/Echo sounders (45%) and other electronic gadgets (32%) show the consequent level of utilization by the fishermen. The least level of utilization was held by e-fishing (3%) and internet linkages (2%).

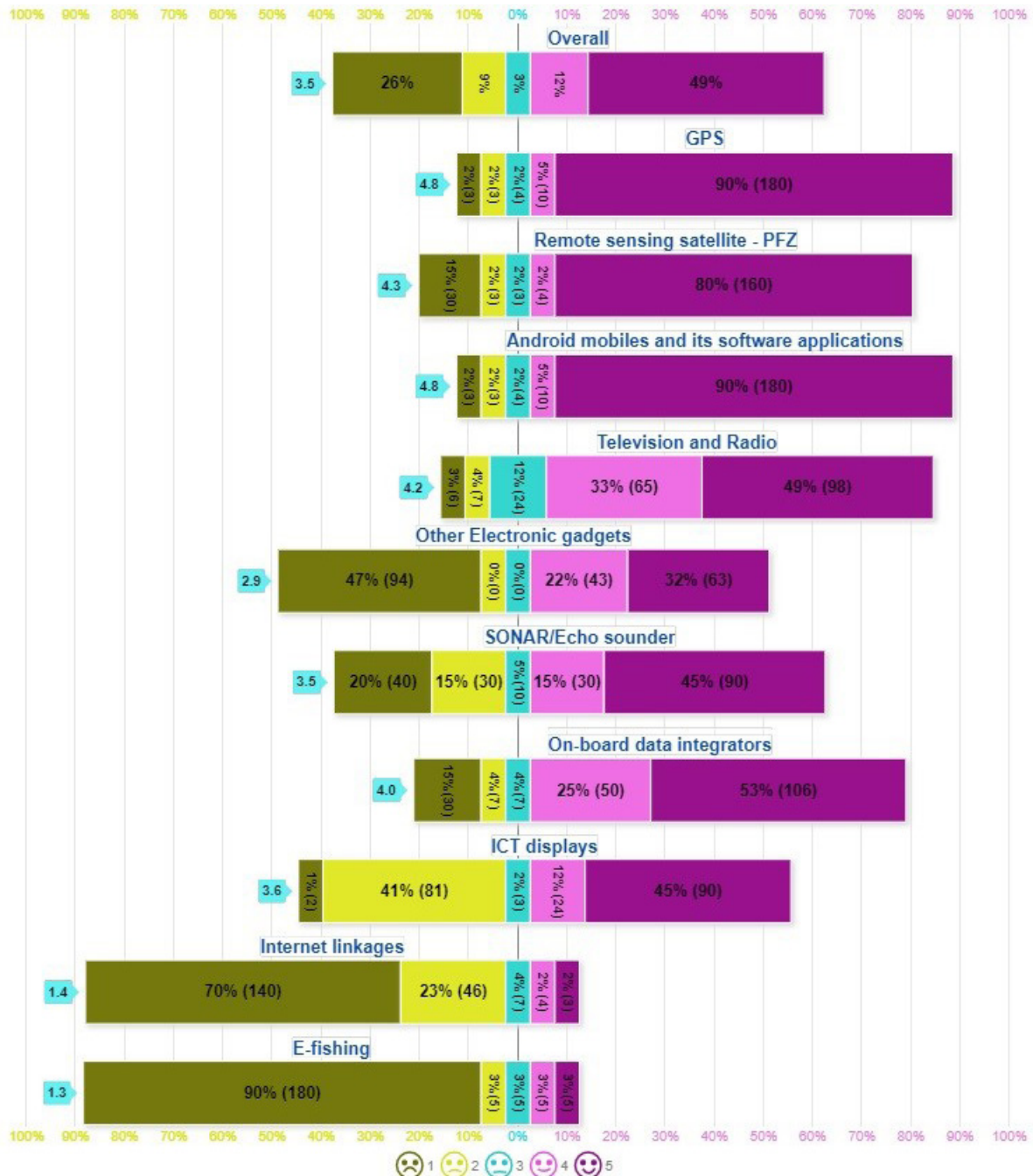


Fig. 2. Degree of utilization of Information and communication technology tools for fishing.

CONCLUSION

The current investigation offers noteworthy perspectives on the revolutionary function of ICT in augmenting the standard of living of fishermen. The results show an unambiguous connection between enhanced fishing efficiency and the utilization of ICT technologies. The findings of the study state that fishermen who actively engage with ICT tools such as mobile phones, GPS and satellite imaging, experience enhanced decision-making capabilities, allowing them to optimize their fishing practices. This technological integration not only facilitates the real-time information sharing but also empowers fishermen to navigate more effectively, thereby increasing their profitability. Moreover, the research undergone to analyze the socio-economic factors influencing the adoption of ICT tools. This suggests a need for targeted training and awareness programs to bridge the digital divide among fishermen, particularly in less ICT exposed coastal areas. In conclusion, the study advocates for the continued promotion and integration of ICT tools within the fishing sector in Tamil Nadu. By fostering an environment conducive to technological adoption, stakeholders can enhance the resilience and sustainability of fishing communities, ultimately contributing to broader economic growth and food security in the region. Future research should explore the long-term impacts of ICT tools utilization for fishing on the socio-economic status of fishermen and the potential for scaling these technologies across other coastal districts in India. This study emphasizes the significance of ICT is to modernizing the fishing industry and boosting fishermen's standard of living. It emphasizes the need for focused training initiatives to improve fishermen's ICT literacy in less accessible areas.

DECLARATIONS

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Ethical statement and IRB approval

Ethical approval for this study was obtained from the Department of Fisheries Extension, Economics and Statistics, TNJUF-Fisheries College and Research Institute, Thoothukudi.

Consent for publication

After the manuscript correction, all the authors have agreed to submit it for publication.

Generative AI and AI-assisted technology statement

The authors declare that no generative AI was used in the creation of this manuscript.

Statement of conflict of interest

The authors have declared no conflict of interest.

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